



DRAFT Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs

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List of Acronyms and Abbreviations

Bcf	<i>Billion cubic feet; a unit typically used to define gas production volumes in the coalbed methane industry; 1 Bcf is roughly equivalent to the volume of gas required to heat approximately 12,000 households for one year (based on the Department of Energy's average household energy consumption statistic, 2001)</i>
Bgs	<i>Below ground surface</i>
Btu	<i>British thermal unit; a unit of measure used to define energy</i>
CBM	<i>Coalbed methane</i>
CERCLA	<i>Comprehensive Environmental Response Compensation and Liability Act</i>
CFR	<i>Code of Federal Regulations</i>
CMHPG	<i>Carboxymethyl hydroxypropylguar; a form of guar gel</i>
COGCC	<i>Colorado Oil and Gas Conservation Commission</i>
DMME	<i>Virginia Division of Oil and Gas, within the Department of Mines, Minerals and Energy</i>
DOE	<i>Department of Energy</i>
EPA	<i>Environmental Protection Agency</i>
GRI	<i>Gas Research Institute</i>
GSA	<i>Geological Society of Alabama</i>
HCl	<i>Hydrochloric acid</i>
HEC	<i>Hydroxyethylcellulose; a form of guar gel</i>
HPG	<i>Hydroxypropylguar</i>
KCl	<i>Potassium chloride</i>
LEAF	<i>Legal Environmental Assistance Foundation</i>
Mcf	<i>Million cubic feet; a unit typically used to define gas production volumes in the coalbed methane industry; 1 Mcf is roughly equivalent to the volume of gas required to heat approximately 12 households for one year (based on the Department of Energy's average household energy consumption statistic, 2001); Mcf can sometimes represent 1000 cubic feet (instances where this is so in the report are clearly noted)</i>

Mcf/d	<i>Million cubic feet per day; a unit typically used to define gas production rates in the coalbed methane industry; 'Mcf/d' can sometimes represent 1000 cubic feet per day (instances where this is so in the report are clearly noted)</i>
mg/L	<i>Milligrams per liter; typically used to define concentrations of a dissolved compound in a fluid</i>
Mgal	<i>Million gallons; a unit typically used to describe fracturing fluid volumes in the coalbed methane industry; equivalent to the volume of water required to fill two Olympic-size swimming pools (one pool contains approximately 500,000 gallons of water)</i>
MSDS	<i>Material Safety Data Sheets</i>
NMOCD	<i>New Mexico Oil Conservation Division</i>
OGB	<i>Oil and Gas Board of Alabama</i>
OGWDW	<i>Office of Ground Water and Drinking Water</i>
ppm	<i>Parts per million; typically used to define concentrations of a dissolved compound in a fluid; equivalent to 1 mg/L</i>
PRBRC	<i>Powder River Basin Resource Council</i>
PRCMIC	<i>Powder River Coalbed Methane Information Council</i>
psi	<i>Pounds per square inch; a unit of pressure</i>
SDWA	<i>Safe Drinking Water Act</i>
Tcf	<i>Trillion cubic feet; a unit typically used to define gas production volumes in the coalbed methane industry; 1 Tcf is roughly equivalent to the volume of gas required to heat approximately 12 million households for one year (based on the Department of Energy's average household energy consumption statistic, 2001)</i>
TDS	<i>Total dissolved solids</i>
UIC	<i>Underground Injection Control; a program established by EPA under the SDWA</i>
USDW	<i>Underground Source of Drinking Water</i>
USGS	<i>United States Geological Survey</i>
wt.	<i>Weight</i>

Glossary

Adsorption	<i>Adhesion of gas molecules, ions or molecules in solution to the surface of solid bodies with which they are in contact</i>
Amphoteric	<i>Having both basic and acidic properties</i>
Anaerobic Bacteria	<i>Bacteria that thrive in oxygen-poor environments</i>
Anisotropic	<i>Having some physical property that varies with direction</i>
Annulus	<i>The space between the casing (the material that is used to keep the well stable; typically this material is steel) in a well and the wall of the hole, or between two concentric strings of casing, or between casing and tubing</i>
Anticline	<i>A fold of layered, sedimentary rocks whose core contains stratigraphically older rocks, the shape of the fold is generally convex upward</i>
Aureole	<i>A ring surrounding a volcanic intrusion where the surrounding rock has been altered</i>
Azimuth	<i>The direction of a horizontal line as measured on an imaginary horizontal circle</i>
Biogenic	<i>A direct product of the physiological activities of organisms</i>
Bituminous	<i>From the base word bitumen, referring to a general term for various solid and semi-solid hydrocarbons that are able to join together and are soluble in carbon bisulfide (e.g., asphalts)</i>
Breaker	<i>A fracturing fluid additive that is added to break down the viscosity of the fluid</i>
Breccia	<i>A coarse-grained clastic rock composed of angular broken rock fragments held together by a mineral cement or a fine-grained matrix</i>
Butt Cleat	<i>The coal cleat set that abuts into face cleats</i>
Cavitation Cycling	<i>Also known as cavity completion, an alternative completion technique to hydraulic fracturing, in which a cavity is generated by alternately pumping in nitrogen and blowing down pressure</i>
Cleats	<i>Natural fractures in coal that often occur in systematic sets, through which gas and water can flow</i>
Craton	<i>A part of the earth's crust that has attained stability and has been relatively undeformed for a long time; the term is restricted to continents, and includes both shield and platform</i>

Crosslinker	<i>An additive that when added to a linear gel, will create a complex, high viscosity, pseduoplastic fracturing fluid</i>
Crosslinked Gel	<i>A gel to which a crosslinker has been added (see crosslinker)</i>
De-sorbtion	<i>Liberation of tightly held methane gas molecules previously bound to the solid surface of the coal</i>
Evapotranspiration	<i>The portion of precipitation returned to the air through evaporation and transpiration</i>
Face Cleat	<i>A coal cleat set that is through-going and continuous</i>
Flowback	<i>The process of causing fluid to flow back to the well out of a fracture after a hydraulic fracturing event is completed</i>
Fracture Conductivity	<i>The capability of the hydraulic fracture to conduct fluids under a given pressure difference</i>
Geophone	<i>A seismic detector, placed on or in the ground, that responds to ground motion at its point of location</i>
Graben	<i>An elongate, down-dropped block that is bounded by nearly parallel faults on both sides</i>
Guar	<i>Organic powder thickener, typically used to make viscous fracturing fluids, completely soluble in hot and cold water, insoluble in oils, grease and hydrocarbons</i>
Hydraulic Conductivity	<i>(see permeability)</i>
HCl	<i>Molecular formula for hydrochloric acid; can be used in diluted form in the hydraulic fracturing process to fracture limestone formations and to clean up perforations in coalbed methane fracturing treatments</i>
Injectate	<i>In relation to the coalbed methane industry, this is the fracturing fluid injected into a coalbed methane well</i>
Isopach	<i>A line drawn on a map through points of equal true thickness of a designated stratigraphic unit or group of stratigraphic units</i>
Isotopic	<i>Rocks formed in the same environment, i.e. in the same sedimentary basin or geologic province</i>
Isotropic	<i>A medium, such as unconsolidated sediments or a rock formation, whose properties are the same in all directions</i>

KCl	<i>Molecular formula for potassium chloride; typically added to injected water to increase the viscosity</i>
Lacustrine	<i>Pertaining to, produced by, or formed in a lake or lakes</i>
Laminar Flow	<i>Water flow in which the stream lines remain distinct and the flow direction at every point remains unchanged with time; non-turbulent flow</i>
Lenticular	<i>Pertaining to a discontinuous, lens-shaped (saucer-shaped) stratigraphic body</i>
Linear Gel	<i>A simple guar-based fracturing fluid usually formulated using guar and water with additives or guar with diesel fuel</i>
Lithology	<i>The description of rocks based on mineralogic composition and texture</i>
Millidarcy	<i>The customary unit of measurement of fluid permeability; equivalent to 0.001 Darcy</i>
Overthrust	<i>A low-angle thrust fault of large scale, with total displacement (lateral or vertical) generally measured in kilometers</i>
Pad	<i>Fluid that is used to transport proppant into a fracture</i>
Paleochannels	<i>Old or ancient river channels preserved in the subsurface as lenticular sandstones</i>
Permeability	<i>The capacity of a porous rock, sediment, or soil to transmit a fluid; it is a measure of the relative ease of fluid flow under equal pressure</i>
Physiographic	<i>A region of which all parts are similar in geologic structure and climate and which has had a unified geomorphic history; its relief features differ significantly from those of adjacent regions</i>
Play	<i>A productive coalbed methane formation, or a productive oil or gas deposit</i>
Potentiometric	<i>The total head of ground water, defined by the level to which water will rise in a well</i>
Primacy	<i>The right to self-establish, self-enforce and self-regulate environmental standards; this enforcement responsibility is granted by EPA to States and Indian Tribes</i>
Proppant	<i>Granules of sand, ceramic or other minerals that are wedged within the fracture and act to “prop” it open after the fluid pressure from fracture injection has dissipated</i>
Rank	<i>The degree of metamorphism in coal; the basis of coal classification into a natural series from lignite to anthracite</i>

Screen-out	<i>Term used to describe a fracturing job where proppant placement has failed; wells that have been “screened-out” can not be used for gas production</i>
Semianthrinite	<i>Term used to identify coal rank; specifically representing coal that possesses a fixed-carbon content of 86% to 92%</i>
Stratigraphy	<i>The study of rock strata; concerning all characteristics and attributes of rocks and their interpretation in terms of mode of origin and geologic history</i>
Subbituminous	<i>A black coal, intermediate in rank between lignite and bituminous</i>
Subgraywacke	<i>A sedimentary rock (sandstone) that contains less feldspar, and more and better-rounded quartz grains than graywacke; intermediate in composition between greywacke and orthoquartzite; it is lighter-colored and better-sorted, and has less matrix than graywacke</i>
Surficial	<i>Pertaining to or lying in or on a surface; specific to the surface of the earth</i>
Syncline	<i>A fold of layered, sedimentary rocks whose core contains stratigraphically younger rocks; shape of fold is generally concave upward</i>
Thermogenic	<i>A direct product of high temperatures, (e.g. Thermogenic methane)</i>
Transmissivity	<i>A measure of the amount of water that can be transmitted horizontally through a unit width by the full saturated thickness of the aquifer under a hydraulic gradient of one</i>
Up-warp	<i>The uplift of a region; usually a result of the release of isostatic pressure, e.g. the melting of an ice sheet</i>
Viscosity	<i>The property of a substance to offer internal resistance to flow; internal friction</i>